Bose-Einstein condensation of magnons in the spin-1 chain $NiCl_2{\cdot}4SC(NH_2)_2$ studied by μ^+SR

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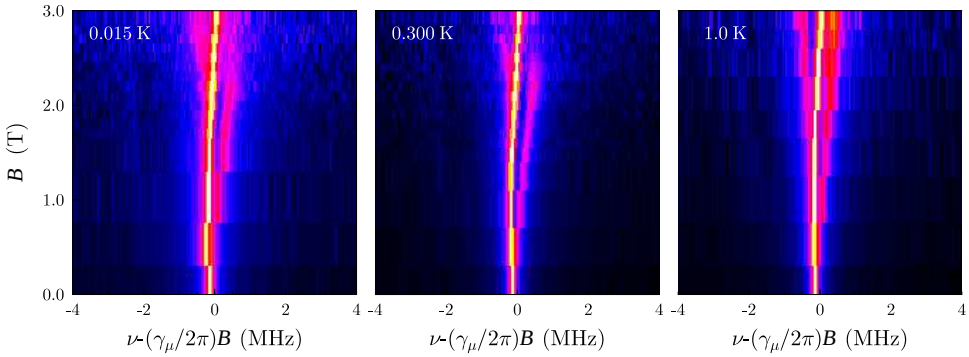
Quantum systems containing $S = 1$ moments which exhibit a Bose-Einstein condensation (BEC) of magnons rely on a gap between the singlet ground-state and the excited triplet state which is closed by applied magnetic field; exchange interactions broaden the gap-closing transition to a region of XY long-range order, stable between a lower critical field B_{c1} and an upper critical field B_{c2}, above which a triplet ground state is stabilised. The compound $NiCl_2{\cdot}4SC(NH_2)_2$ [1] is a $S = 1$ chain system exhibiting this effect [2]. Its low value of $B_{c1} = 2.1\,\mathrm{T}$ makes it accessible to study using μSR. Moreover, unlike other BEC systems (e.g. $TlCuCl_3$), this material has a strong single-axis anisotropy with rotational symmetry in the *ab* plane which allows conservation of magnons. We have used high-transverse field μSR to study single crystals of $NiCl_2.4SC(NH_2)_2$ with applied fields parallel and perpendicular to the *c*-axis up to 3 T at temperatures down to 15 mK. Our results allow us to characterize the phase diagram of this system on the basis of a local measurement of the spin structure and dynamics.



[1] A. Padhuan-Filho et al., Phys. Rev. B 69, 020405 (2004).
[2] V.S. Zapf et al., Phys. Rev. Lett. 96, 077204 (2006); ibid 98, 047205 (2007).